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DC CONDUCTIVITY STUDIES OF AN HYDROXIDE ION CONDUCTOR
AT INTERMEDIATE TEM (U) STANFORD UNIV CA DEPT OF
MATERIALS SCIENCE AND ENGINEERING
S CROUCH-BAKER ET AL 30 JUL 87 TR-7

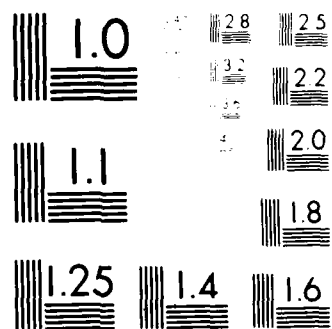
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DC Conductivity Studies of an Hydroxide Ion Conductor
at Intermediate Temperatures

by

S. Crouch-Baker and R. A. Huggins

Submitted to the Journal of the Electrochemical Society

Stanford University
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ionic conductivity of Li_5AlO_4 in a wet environment in the temperature range 415 - 450°C. This was not observed in a dry environment. A similar increase was also found with pure LiOH , and it was suggested (10,11) that the large conductivity increase in Li_5AlO_4 in a wet environment is due to the formation of LiOH in the grain boundaries, according to the reaction:

$$\text{Li}_5\text{AlO}_4 + 2 \text{H}_2\text{O} = 4 \text{LiOH} + \text{LiAlO}_2$$

In addition, the results of DC polarization experiments were interpreted (9-11) as indicating the presence of appreciable amounts of electronic conduction in some cases.

In this work, the DC conductivity of wet Li_3AlO_4 samples has been measured as a function of temperature and applied voltage. It is proposed that, under the conditions employed in this work, DC charge conduction is due to the transport of hydroxide ions derived from the LiOH contained in the structure, rather than by electronic species.

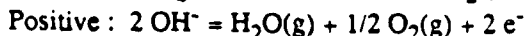
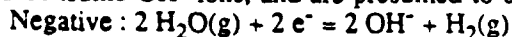
EXPERIMENTAL METHODS

RESULTS AND DISCUSSION

***Electrochemical Society Active Member.**
Key words: conductivity, hydroxide, electrolysis.

that, in this range, the conductivity rises sharply at approximately 1 V and begins to level off at higher voltages. In carrying out these experiments, continuous DC conductance, i.e. without current interruption, was observed for up to ten hours. The results were considerably different when measurements were made in a water-free environment. The initial conductance was lower, and decreased rapidly to negligible values.

The sharp rise in apparent conductivity shown in Fig. 2 is due to a change in the electrode reactions at approximately 1 V. This value corresponds closely to that calculated for the electrolysis of water vapor (1.07 V at 500°C) in the relatively narrow temperature range studied here. Hence, above 1 V the electrode reactions produce and consume OH^- ions, and are presumed to be:



Thus the overall reaction results in the transport of OH^- through the electrolyte, presumably with the decomposition of water vapor, leading to the production of hydrogen on the negative electrode side and oxygen on the positive electrode side of the cell.

Hence, such materials show promise as potential electrolytes for the electrolysis of steam at intermediate temperatures. Further studies are underway.

ACKNOWLEDGEMENT

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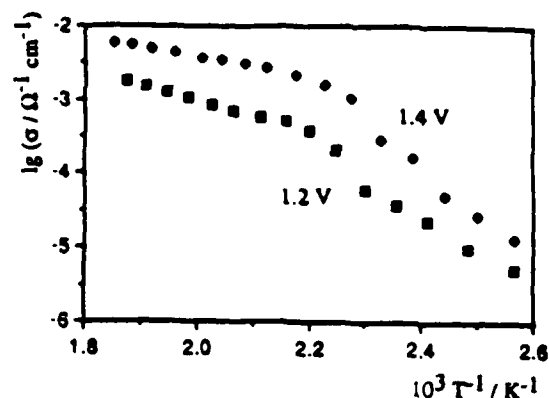


Fig. 1. Variation of DC conductivity with reciprocal temperature for wet Li_5AlO_4 . Results are shown for two different applied voltages.

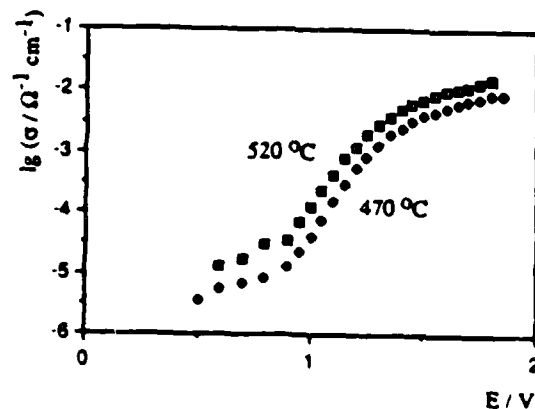


Fig. 2. Variation of DC conductivity with applied voltage, E , for wet Li_5AlO_4 . Results are shown for two different temperatures.

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